

The particle size distribution of the glass powders was determined using a laser diffraction particle size analyzer (produced by Shimadzu Corporation under the trade name of SALD-2000J) to calculate D50. In this procedure, the maximum particle diameter (Dmax) was defined as the 99.9% point of a cumulative particle size distribution.

In the calculation of the particle size distribution, 1.9 and 0.05i were employed as the real part and imaginary part of a complex index of refraction, respectively.

The above-prepared glass powders were found to have a softening point of from 540°C to 615°C, a dielectric constant of from 6.5 to 11.0, and a thermal expansion coefficient of from  $65 \times 10^{-7}/^{\circ}\text{C}$  to  $85 \times 10^{-7}/^{\circ}\text{C}$  (at temperatures ranging from 30°C to 300°C).

#### [Filler Powders]

Table 4 shows the compositions of the filler powders for use in the barrier rib material for the plasma display panel.

Table 4

	a	b	c	d	e	f	g	h	i
COMPOSITION (mass%)									
silica	50	50	30	50	30	50	50	—	100
$\alpha$ -quartz	60	75	50	70	30	95	3	—	50
silica glass	40	25	50	30	70	5	97	—	50
alumina	50	35	70	50	70	50	50	100	—
titanium oxide	—	15	—	—	—	—	—	—	—

Filler powders (Samples a to i) were prepared by uniformly admixing components in the compositions indicated in Table 4. In this procedure, the  $\alpha$ -quartz powder, quartz glass powder and alumina powder each had D50 of 2.0  $\mu\text{m}$  and Dmax of 10.0  $\mu\text{m}$ . The titanium oxide powder had D50 of 0.5  $\mu\text{m}$  and Dmax of 5.0  $\mu\text{m}$ .

## [Barrier Rib Materials]

Tables 5 and 6 show the characteristics of examples (Samples Nos. 1 to 11) and comparative examples (Samples Nos. 12 to 15) of the barrier rib materials for plasma display panels.

Table 5

	EXAMPLES						
	1	2	3	4	5	6	7
GLASS POWDER TYPE	A	B	C	D	E	F	G
CONTENT (mass%)	85	70	65	85	70	85	75
FILLER POWDER TYPE	e	a	c	b	d	c	b
CONTENT (mass%)	15	30	35	15	30	15	25
SOFTENING POINT (°C)	575	565	570	610	610	620	570
DIELECTRIC CONSTANT (25°C, 1MHZ)	10.0	7.0	10.0	9.0	9.0	8.5	10.0
COEFFICIENT OF THERMAL EXPANSION [30–300°C (×10 <sup>-7</sup> /°C)]	65	67	69	82	70	66	81
CRACKING LOAD (g)	200	200	250	200	200	200	200

Table 6

	EXAMPLES				COMPARATIVE EXAMPLES			
	8	9	10	11	12	13	14	15
GLASS POWDER TYPE	H	I	B	H	D	A	G	G
CONTENT (mass%)	75	70	90	60	80	80	80	80
FILLER POWDER TYPE	a	c	e	a	f	g	h	i
CONTENT (mass%)	25	30	10	40	20	20	20	20
SOFTENING POINT (°C)	585	580	545	605	620	580	575	570
DIELECTRIC CONSTANT (25°C, 1MHZ)	9.0	10.0	8.0	7.5	8.5	6.0	11.0	9.5
COEFFICIENT OF THERMAL EXPANSION [30–300°C (10 <sup>-7</sup> /°C)]	80	83	67	76	95	54	83	78
CRACKING LOAD (g)	200	200	150	250	200	200	200	100

The barrier rib materials for plasma display panels were prepared by admixing each of the glass powders shown in Tables 1 to 3 with each of the

filler powders shown in Table 4 in the compositional ratios indicated in Tables 5 and 6.

The softening point, dielectric constant, thermal expansion coefficient and cracking load of the barrier rib materials were determined.

Samples Nos. 1 to 11 as inventive examples each had a low dielectric constant of less than or equal to 10.0 and a cracking load of equal to or more than 150 g and had sufficient mechanical strength for practical use.

Additionally, these samples each had a low softening point of less than or equal to 620°C and thereby formed barrier ribs at firing temperatures of less than or equal to 600°C. These samples also had a thermal expansion coefficient of from  $65 \times 10^{-7}/^{\circ}\text{C}$  to  $83 \times 10^{-7}/^{\circ}\text{C}$ , close to that of a glass substrate, thus avoiding a crack or peeling of the barrier ribs.

In the determination of the softening point, each of the samples was subjected to differential thermal analysis using a macro differential thermal analyzer, and the softening point was defined as the temperature at a fourth inflection point in the resulting curve.

In the determination of the dielectric constant, each of the samples was subjected to dry powder pressing and firing (curing), and the dielectric constant of the fired sample was determined at 25°C and, 1 MHz by a disk process. Each of the samples was separately subjected to dry powder pressing and firing, and the fired sample was ground to a cylinder 4 mm in diameter and 40 mm in length. The thermal expansion of the cylinder was measured by a method pursuant to Japanese Industrial Standards (JIS) R3102, and the thermal expansion coefficient within temperatures ranging from 30°C to 300°C was calculated.

The cracking load indicates the mechanical strength of the barrier rib material, and the mechanical strength of the barrier rib material increases with an increasing cracking load. The cracking load was determined in the